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The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana's vegetation in past decades. Authors were Butler faculty, current and former master's degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler's first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal's publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor's degrees and 75 master's degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner , included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master's students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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THE FOREST PRIMEVAL OF MARION AND JOHNSON COUNTIES, INDIANA, IN 1819*

By MARILYN BOWMAN BLEWETT AND J. E. POTZGER

The original forest of eastern North America has been acclaimed the most magnificent deciduous forest the world ever produced, but agriculture encroached very rapidly on this forest so that today in whole counties one cannot find a good representative stand of timber of the primeval forest. This is particularly true for states like Indiana where many counties were blessed with excellent soil, suited to agriculture. Marion and Johnson counties, Indiana are good representatives of such conditions. Fortunately, the original forest has, even though in a meagre way, been recorded both qualitatively and quantitatively by the surveyors working on the original U. S. land survey before the state was divided into county units. For the two counties considered here the record dates back to 1819.

While comparatively few trees enter the tabulation from an extensive area, they may, however, quite accurately portray the percentage relationship of the various tree species which constituted the original forest, as well as the association complex itself. To say the least, they are more reliable and diagnostic than mere verbal descriptions of travelers who chanced to pass through the region in early days of the state.

It is very likely that a few representatives of a mass of vegetation taken at widely separated points within a large area give the same picture as does a concentrated tabulation of a small area. We find this to be true in other situations. At the grain elevator each truck load of seeds is not inspected in its entirety, but quality is determined on basis of a small representative sample. In bacteriology the dilution method used to obtain quantitative and qualitative information on a given culture is without argument accepted as reliable basis for such a study. Still another example of the law of averages is found in the pollen analysis procedure. Small cores are taken from a bog and still smaller samples of these are analyzed, and the pollen present

* This is contribution 236 from the Botanical Laboratory of Butler University, Indianapolis, Indiana.

is used to show percentage relationships of the genera which constituted the forest composition of long ago. All such analyses are based on the assumption that the fractional part of a mass is like the whole mass. We assume operation of this law in the present situation.

Marion and Johnson counties were chosen for this study because they adjoin and are located in the glaciated central part of the state where physiography and soil are very similar. The flat tillplain has little relief except where a few streams cut into the unconsolidated glacial till.

METHODS

Land surveyors had the custom of recording the diameter and species name of two trees, called "witness trees," at each section and quarter section corners. At times additional trees were recorded at intermediate points, especially along river courses. This information we copied on special large sheets showing townships by sections and quarter section division. Since the survey was made before county boundaries were determined, the township or fraction of townships included in a given county were indicated, together with proper range and township designation, on specially ruled worksheets. In fact, the worksheets were duplicates of the divisions shown in the county records deposited in the State Auditor's office. Names of trees and their respective diameters were entered on the township work sheets. From these records final tabulations for percentage representation of various species were made as shown in tables I and II.

The records of the original land survey are filed in the State Auditor's office. Data for Marion County were obtained at the County Surveyor's office. We are grateful to the officials at both offices for the cordial welcome we were given and for the ready help that was given our work.

By way of comparison, a detailed forest survey was made of a comparatively little disturbed stand of climax forest on the Fort Harrison Reservation, near Indianapolis. Results of that survey based on tweny 10-meter-square quadrats are shown in table V.

OBSERVATIONS

The data summarized in tables I and II plainly show that both counties were fine representatives of the climax mixed mesophytic

type where Fagus and *Acer saccharum* played the most prominent role. Diameter of stems was mostly below 30-inches DBH. (tables III and IV). The status of reproduction can be inferred from the abundance of stems in the 3-inch to 6-inch size-classes. Genera and species showing highest abundance in these size-classes are *Acer saccharum, Fagus grandifolia* and Fraxinus sp.?. *Fagus grandifolia* and *Acer saccharum* combined constitute one-half or more of the stems in all but five of the 28 townships, and Fagus alone has 50 per cent representation or more in most of them, reaching a maximum of sixty-nine per cent in Johnson County (tables I and II). While the oaks are much less abundant in number of stems, and appear to reproduce more sparingly than either beech or sugar maple, they have more large stems than eitber of the species just referred to (tables III, IV). Carya does not exceed an abundance of ten per cent in any one township. *Quercus alba* is more abundant than any other species of oak but it, too, does not exceed ten per cent in any township (table 1). Combining hickory with oaks as an ecological group, their maximum representation (Marion County) is 19 per cent (T. 14 N., R. 2 E.) but in most townships it does not exceed ten per cent.

Fraxinus sp? are consistently represented in every township of both counties. They, too, give the impression that reproduction was bigh. Ulmus is a consistent associate in the forest complex, but this genus is less abundant than Fraxinus. This one would expect in a mixed-mesophytic forest cover, where elm is, being a subclimax floodplain dominant. somewhat out of its optimum habitat requirements. The reports listed 34 species and genera for Marion County and 36 for Johnson County.

Juglans nigra and *Liriodendron tulipifera* are sparsely represented, but they contributed some of the largest stem-diameters recorded. The following are species (numbers of such stems are given in parentheses) which have representatives 32-inches and over in diameter: *Acer saccharum* 32 (1), 36 (3); *Fagus grandifolia* 34 (1), 36 (16); *Carya* 32 (1); *Quercus alba* 33 (1), 34 (1), 36 (5), 38 (1), 40 (2), 48 (4), 50 (2), 60 (1), 80 (1): *Quercus borealis* var. *maxima* 33 (1), 36 (3), 38 (1), 40 (1), 48 (5); Quercus sp.? 36 (1), 40 (3), 48 (5), 60 (1); *Quercus velutina* 35 (1), 36 (2), 50 (1), 80 (1); *Juglans nigra* 33 (1), 36 (1), 48 (5); *Liriodendron tulipifera* 36 (6), 40 (1),

48 (3), 50 (3), 60 (3) ; Fraxinus sp.? 36 (2), 38 (2), 40 (4), 48 (1) ; Ulmus sp.? 33 (1), 36 (9), 40 (1), 46 (1), 48 (3) ; *Platanus occidentalis* 33 (1), 36 (4), 48 (2), 75 (1), 84 (1).

Of the second layer trees, Carpinus and Ostrya have the highest representation in number of stems. The quadrat study at Fort Harrison (table V) presents a forest association very similar to that indicated for Marion and Johnson counties as a whole (tables I and II), except that numbers of species recorded are less in the Fort Harrison stand. However, even the number of species is comparable when one considers any one township in comparison with the quadrat study.

DISCUSSION

In order to understand the significance of a particular forest type, it is necessary to keep in mind that the association did not just happen but is the result of interactions of many factors. Chief among these is, no doubt, climate, hut physiography (microclimate) is unquestionably the determiner of heterogencous pattern in the great broadleaved forest, where so many species are favored by the climate as a whole. While in a study as the one we present here one cannot well determine the part which microclimate played in the selection of species and associations of species, it can very well be inferred from the fluctuation of abundance of oak-hickory, beech-maple, beech-maple-elm-buckeye in a fractional part of the area (tables I and II).

If one would determine crown cover on basis of group of species having highest per cent abundance in a township there appear up to ten different forest-cover types.

As frequently pointed out by Potzger (1, 2), Potzger and Friesner (3), and Potzger, Friesner and Keller (4), the ultimate climax vegetation for Indiana is apparently a mixed mesophytic forest in which beech and sugar maple are the most important species. The forest primeval of both Marion and Johnson counties was so constituted. These two counties are fine representative locations where good soil with adequate drainage made possible development of the climax forest. Results of the survey also encourage the conclusion that small stands of comparatively little disturbed forest quite accurately picture the association complex of the primeval forest.

SUMMARY

1. The paper presents data on trees listed in the original U. S. land survey records of Marion and Johnson counties, Indiana.

2. The surveyors list 34 genera and species for Marion County and 36 for Johnson County.

3. A twenty 10-meter-square quadrat study of a relatively little disturbed stand on the Fort Harrison Reservation, near Indianapolis, is presented for comparison.

4. Both counties were apparently covered mostly by typical climax mixed mesophytic forest in which beech and sugar maple were the most important representatives.

5. Beech totalled on an average 50 per cent or more of the total number of stems. Sugar maple was a consistent associate but seldom equalled the abundance of beech.

6. *Liriodendron tulipifera* and *Juglans nigra* were consistently sparsely represented in the forest association, but they played a prominent role in the large-size stems.

7. Results of the quadrat study of a single stand on the Fort Harrison Reservation compare very favorably with the results obtained from the survey records. The opinion is expressed that surveys of small stands of little disturbed forest very likely yield quite accurately the association complex and quantitative representation of species in the forest primeval.

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TABLE I

Percentage which a given tree species had of the total number of stems recorded in townships of Marion County, Indiana, in 1819

Species	T 14 N R.2E	T 14 N R.3E	T 14 N R.4E	T 14 N R.5E	T 15 N R.2E	T 15 N R.3E	T 15 N R.4E	T 15 N R.5E	T 16 N R.2E	T 16 N R.3E	T 16 N R.4E	T 16 N R.5E	T 17 N R.2E	T 17 N R.3E	T 17 N R.4E	T 17 N R.5E
Acer saccharum	9.73	7.31	6.62	5.49	21.87	13.02	7.56	8.53	18.39	23.55	11.66	10.90	15.32	9.09	11.73	6.78
Fagus	53.09	27.43	45.18	60.43	32.03	20.16	62.60	48.17	37.35	25.61	52.08	54.54	35.76	39.77	46.92	57.62
Carya sp?	6.19	9.75	2.41	3.29	5.46	7.98	5.04	1.82	2.87	7.43	4.58	6.06	5.84	10.79	10.61	2.54
Quercus alba	10.61	9.75	5.42	1.09	8.59	3.78	4.20	6.09	6.32	1.65	4.16	1.81	2.18	2.84	2.23	1.69
Q. borealis maxima	x	x	1.80	x	.78	x	.42	x	x	x	1.66	2.42	x	x	x	x
Quercus sp?	.88	x	x	x	.78	1.26	.42	1.21	x	x	x	x	.73	.56	.55	.84
Quercus velutina	1.77	1.82	.60	2.19	x	.42	x	x	.57	.82	.41	x	2.18	x	.55	.84
Juglans	2.65	.61	1.20	1.09	5.46	2.94	.42	2.44	2.87	.82	1.25	.60	3.64	4.54	1.11	.84
Liriodendron	3.54	x	2.41	x	.78	x	x	2.44	.57	.82	1.25	.60	1.46	2.84	1.11	.84
Celtis	x	6.70	x	x	.78	8.82	.42	1.22	1.45	4.95	.83	x	1.46	.56	1.67	2.54
Fraxinus quad.	x	x	x	x	x	x	x	x	.57	.41	x	x	x	x	x	x
Fraxinus sp?	4.42	9.14	19.87	15.38	4.68	7.56	10.50	15.24	7.47	7.02	8.75	12.72	7.30	10.22	13.40	10.17
Ulmus sp?	x	6.70	7.22	6.59	5.46	6.72	2.94	3.04	5.17	5.78	6.25	6.06	3.65	6.81	2.79	4.23
Carpinus	.88	1.83	1.20	x	2.34	.42	1.68	.61	1.15	.82	1.66	x	2.92	1.70	x	2.54
Ostrya	1.77	6.09	1.80	x	.78	3.36	x	x	1.15	1.65	x	x	2.92	1.13	.55	x
Acer negundo	x	x	.60	x	x	1.26	x	x	.57	.82	x	x	x	x	x	x
Aesculus	1.77	9.75	x	x	3.90	16.80	1.26	1.83	6.32	10.74	2.50	1.21	9.49	6.25	2.79	7.62
Asimina	x	x	x	x	x	.421	x	x	x	x	x	x	x	x	x	x
Cercis	x	x	x	x	x	.421	x	x	x	x	x	x	x	x	x	x
Cornus florida	.8849	x	x	2.19	.78	x	.42	.61	.57	1.24	.41	.73	.56	1.21	.55	x
Crataegus sp?	x	x	.60	x	x	x	x	.61	.57	x	x	x	x	x	.55	x
Fraxinus americana	x	x	x	x	x	.42	.42	x	2.87	.41	.83	1.21	x	x	x	x
Gleditsia triacanthos	x	.61	x	x	.78	.42	x	x	x	x	x	x	x	x	x	x
Gymnocladus	x	x	x	x	x	.42	x	x	x	x	x	x	x	x	x	x

TABLE I—(Continued)

Percentage which a given tree species had of the total number of stems recorded in townships of Marion County, Indiana, in 1819

Species	T 14 N R.2E	T 14 N R.3E	T 14 N R.4E	T 14 N R.5E	T 15 N R.2E	T 15 N R.3E	T 15 N R.4E	T 15 N R.5E	T 16 N R.2E	T 16 N R.3E	T 16 N R.4E	T 16 N R.5E	T 17 N R.2E	T 17 N R.3E	T 17 N R.4E	T 17 N R.5E
Morus rubra	x	x	.60	x	x	x	x	.61	x	x	x	x	x	x	x	x
Platanus	1.77	1.22	x	x	1.56	2.10	x	.61	x	2.06	x	x	x	x	x	.84
Populus deltoides	x	.61	x	x	x	.42	x	x	1.15	x	x	x	.73	x	x	x
Populus grandidentata	x	x	x	x	x	1.56	x	x	x	x	x	x	x	x	x	x
Prunus serotina	x	x	.60	x	x	x	x	x	1.15	2.48	x	x	x	1.70	1.11	x
Robinia pseudo-acacia	x	x	.60	x	x	x	x	.61	.57	x	x	x	x	x	.55	x
Salix sp?	x	x	x	x	x	x	x	x	x	x	x	x	1.46	x	x	x
Tilia americana	x	.61	1.20	1.09	1.56	.84	1.68	2.44	.57	.82	.83	.60	1.46	.56	1.67	x
Carpinus	x	x	.60	1.09	x	x	x	2.44	x	x	.83	x	x	x	x	x
White Walnut	x	x	x	x	x	x	x	x	.57	x	x	x	.73	x	x	x

TABLE II

Percentage which a given tree species had of the total number of stems recorded in townships of Johnson County, Indiana, in 1819

Species	T 11 N			T 12 N			T 13 N			T 14 N		
	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E
Acer saccharum	16.25	11.61	15.06	13.48	5.88	.59	11.88	3.41	3.61	7.00	2.02	8.06
Fagus	56.66	53.94	25.90	56.27	55.46	53.89	52.45	55.12	62.04	38.00	60.60	69.35
Carya sp?	5.00	4.56	2.04	2.32	2.52	5.98	2.05	5.12	1.80	8.00	2.02	x
Quercus alba	2.50	2.07	6.02	2.32	2.94	3.58	2.46	4.27	2.41	2.00	1.01	x
Q. borealis maxima	x	1.24	1.80	2.79	2.94	1.78	.81	1.28	x	x	x	x
Q. macrocarpa	x	x	x	x	.42	x	x	x	x	x	x	x
Quercus sp?	.83	3.31	7.83	x	.84	.59	.81	.42	x	2.00	1.01	x
Q. velutina	.83	.41	.60	x	x	x	.81	x	x	3.00	x	x
Juglans	.83	.83	2.41	x	1.26	.59	1.23	.85	.60	x	2.02	1.61
Liriodendron	2.08	3.31	1.80	x	1.68	x	.41	1.28	1.80	x	2.02	x
Celtis	.41	x	4.21	x	2.10	4.78	.81	x	x	9.00	x	x
Fraxinus quad.	.41	.83	.60	.46	.42	.59	x	x	x	x	x	x
Fraxinus sp?	3.75	8.29	7.23	10.69	14.28	12.54	6.96	12.82	14.45	6.00	15.15	11.29
Ulmus sp?	2.08	2.89	4.21	3.25	4.20	4.79	5.32	5.98	6.02	4.00	8.08	3.22
Carpinus	4.16	.83	1.20	3.72	1.26	1.19	4.09	1.28	x	x	1.01	1.61
Ostrya	x	x	x	x	x	x	x	x	x	7.00	x	x
Acer negundo	x	.41	x	x	x	x	x	x	x	1.00	x	x
Aesculus	1.25	.41	2.40	x	1.68	1.19	3.68	x	1.80	7.00	x	1.61
Betula	x	x	x	x	x	x	.82	x	x	x	x	x
Cercis canadensis	x	.41	x	x	x	x	x	x	x	x	x	x
Cornus florida	1.66	2.07	1.80	1.39	.42	1.19	1.23	.42	.60	1.00	1.01	1.61

TABLE II—(Continued)

Percentage which a given tree species had of the total number of stems recorded in townships of Johnson County, Indiana, in 1819 .

Species	T 11 N			T 12 N			T 13 N			T 14 N		
	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E	R.3E	R.4E	R.5E
Crataegus sp?	x	x	.60	x	x	x	x	x	x	x	x	x
Gymnocladus	x	x	x	x	x	.59	x	x	x	x	x	x
Juglans cinerea	x	x	x	x	x	x	.41	x	x	x	x	x
Morus rubra	x	x	x	x	x	x	.41	x	x	x	x	x
Nyssa sylvatica	.83	x	.60	x	x	x	x	x	x	x	x	x
Platanus	.41	x	x	x	.42	1.78	x	.85	x	1.00	x	x
Populus deltoides	x	x	x	x	x	x	x	x	x	1.00	x	x
P. grandidentata	x	x	x	x	x	x	1.23	x	x	x	x	x
Prunus serotina	x	x	x	.46	x	x	.41	.42	.60	1.00	x	x
Robinia pseudo-acacia	x	.41	x	.46	x	.59	x	x	x	1.00	1.01	x
Salix	x	x	x	.46	x	x	x	x	x	x	x	x
Tilia	x	1.65	1.20	1.39	x	.59	.82	.85	x	x	2.02	x
Swamp Ash	x	x	x	x	x	x	.41	.42	x	x	x	x
Spanish Oak	x	x	x	x	x	x	.41	x	x	x	x	x
White Beech	x	.41	1.80	x	1.26	2.96	x	.85	2.41	x	1.01	1.61

TABLE III

Showing number of stems by diameter classes which a given tree had in the 1819 survey records of Marion County, Indiana

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	38	40	44	46	48	50	54	60	70	75	Total Stems
Acer saccharum	3	5	9	14	8	20	2	41	3	55	7	47	9	10	1	37	3	25	1	5	1	9	1	2	2	3	—	6	1	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	332
Fagus	7	15	24	50	38	81	10	125	15	198	4	148	53	53	1	117	1	82	2	22	4	50	6	4	5	5	1	32	—	—	—	—	—	9	—	—	—	—	—	—	—	—	—	—	1173
Carya sp?	5	9	1	13	11	15	1	16	2	38	5	11	1	5	—	16	—	11	1	1	—	2	—	—	—	2	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	168
Quercus alba	—	2	1	3	4	5	—	11	1	17	1	17	4	1	—	6	—	13	1	1	—	8	—	—	—	—	—	10	—	—	1	1	—	—	1	1	—	—	1	1	—	—	—	—	112
Q. borealis	—	—	—	—	—	1	1	1	—	—	—	—	1	1	—	2	—	2	—	—	—	1	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	13
Quercus sp?	—	—	—	—	2	—	—	2	—	2	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	12
Q. velutina	—	1	—	2	—	—	—	—	—	2	—	—	1	—	—	—	—	4	—	1	—	3	—	—	—	—	—	2	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	18
Juglans	—	—	1	1	—	1	—	3	1	4	—	4	1	3	—	4	1	10	—	—	—	3	—	—	—	—	—	4	—	—	1	—	—	1	—	—	—	—	1	—	—	—	—	—	44
Liriodendron	—	—	—	2	1	—	—	—	1	4	—	1	—	1	—	1	—	4	—	—	—	2	—	1	—	—	—	2	—	—	—	—	—	4	—	1	—	—	1	3	—	1	—	—	—	30
Celtis	4	6	3	4	2	2	1	8	—	8	—	6	—	—	—	3	—	5	—	—	—	4	—	—	—	1	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	59
Fraxinus quad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Fraxinus sp?	10	10	5	19	11	22	8	33	3	39	8	19	4	7	2	23	—	19	—	4	—	8	—	1	—	2	—	13	—	—	—	—	—	1	1	2	—	—	1	—	—	—	—	—	275
Ulmus sp?	2	10	1	2	5	12	1	11	4	26	1	13	3	1	—	9	—	12	—	1	—	6	—	1	—	1	1	6	—	—	—	—	—	5	—	—	—	1	3	—	—	—	—	—	138
Carpinus	1	7	4	13	1	5	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	33
Ostrya	3	8	4	7	2	3	—	8	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	37
Acer negundo	1	—	—	—	—	2	—	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
Aesculus	6	13	4	12	10	17	3	30	—	31	—	14	2	2	1	5	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	152
Asimina	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Cercis	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Cornus florida	1	8	6	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16
Crataegus sp?	—	—	1	—	1	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Fraxinus americana	—	—	—	1	—	2	—	—	—	—	—	2	—	—	—	3	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11
Gleditsia triacanthos	—	1	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Gymnocladus	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Morus rubra	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Platanus	—	2	—	2	—	2	—	1	—	1	1	—	—	1	—	—	—	1	—	—	—	3	—	—	—	—	—	1	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	1	18
Populus deltoides	1	—	—	1	—	—	—	1	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
P. grandidentata	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Prunus serotina	—	3	—	—	—	1	1	1	—	4	—	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14
Robinia-pseudo-acacia	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Salix	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Tilia	—	—	—	—	2	3	—	4	—	2	—	5	—	1	—	3	—	4	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	27
White Beech	—	—	3	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8
White Walnut	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2

TABLE IV

Showing number of stems by diameter classes which a given tree had in the 1819 survey records of Johnson County, Indiana

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	38	40	48	50	60	80	Total Stems
Acer saccharum	5	9	7	30	10	13	8	26	4	19	2	12	6	5	—	15	—	9	2	1	—	4	—	2	—	1	—	2	—	—	—	—	—	1	—	—	—	—	—	—	93
Fagus	6	24	38	83	34	59	30	137	19	165	10	86	66	29	4	79	2	112	13	14	1	61	2	9	3	4	—	56	—	—	—	1	—	7	—	—	—	—	—	—	1214
Carya sp?	—	5	6	6	5	6	—	12	1	13	1	6	4	1	—	7	—	15	1	—	—	2	—	1	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	95
Quercus alba	—	1	1	2	2	1	1	6	1	5	—	1	1	2	—	3	—	5	2	—	—	7	—	1	—	—	—	8	—	—	—	—	—	5	—	1	3	1	1	1	62
Q. borealis	—	—	1	—	1	3	—	—	—	2	—	—	—	—	—	—	—	1	—	1	—	2	—	—	3	2	—	2	—	—	—	—	—	3	1	1	4	—	—	—	27
Q. macrocarpa	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Quercus sp?	—	—	—	—	—	1	—	1	—	2	—	1	1	1	—	3	—	3	1	—	—	1	—	—	1	—	—	8	—	—	—	—	—	1	—	3	3	—	1	—	32
Q. velutina	—	1	—	—	—	1	—	—	—	—	—	1	—	—	—	1	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	1	9
Juglans sp?	—	1	—	1	1	1	—	2	—	3	—	1	1	—	—	—	—	5	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	4	—	—	—	22
Liriodendron	1	3	—	1	—	1	—	—	—	1	—	1	2	—	—	3	—	2	1	—	—	2	—	—	—	—	—	2	—	—	—	—	—	2	—	—	2	—	2	—	26
Celtis	—	—	1	3	1	1	1	2	—	10	—	3	2	1	—	2	—	4	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	33
Fraxinus quad.	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	3	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	7
Fraxinus sp?	10	10	5	19	11	22	8	33	3	39	8	19	4	7	2	23	—	19	—	4	—	8	—	1	—	2	—	13	—	—	—	—	—	1	1	2	—	—	—	—	274
Ulmus sp?	3	5	5	13	2	2	1	10	3	11	1	4	2	—	1	6	—	4	—	1	—	9	—	—	1	—	—	5	—	—	1	—	—	4	—	1	—	—	—	—	95
Carpinus	2	9	4	17	3	4	2	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42
Ostrya	1	1	1	—	—	1	—	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
Acer negundo	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Aesculus	1	1	1	4	3	3	2	6	—	5	—	3	1	—	—	2	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	34
Betula	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Cornus florida	2	6	4	13	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	26
Cercis canadensis	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Gleditsia triacanthos	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Crataegus sp?	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Gymnocladus	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Morus rubra	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Nyssa sylvatica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Populus deltoides	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1

TABLE IV—(Continued)

Showing number of stems by diameter classes which a given tree had in the 1819 survey records of Johnson County, Indiana

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	38	40	48	50	60	80	Total Stems
P. grandidentata	—	—	—	—	—	—	—	—	—	1	—	—	2	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Platanus	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	2	—	—	2	—	—	1	8
Prunus serotina	1	1	—	—	—	—	—	2	—	—	—	—	—	—	—	1									—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
Robinia pseudo-acacia	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	5
Salix	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Tilia	—	—	—	1	1	—	1	2	—	2	—	2	3	—	—	—	—	2	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	16
Swamp Ash	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Spanish Oak	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
White Beech	—	4	6	7	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20

TABLE V

Showing number of stems by diameter classes present in twenty ten-meter-square quadrats in the upland forest of Fort Harrison Reservation

Species	1	2	3	4	5	6	7	8	9	12	13	14	15	16	17	18	19	20	21	23	24	Totals
Acer saccharum	98	40	4	1	—	—	—	—	1	—	1	—	—	—	1	—	—	—	—	—	—	146
Fagus	1	2	—	—	—	—	—	—	1	1	1	—	1	1	2	1	3	1	2	1	—	18
Carya cordiformis	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
C. ovata	—	2	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	3
Quercus alba	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
Q. borealis maxima	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Q. muhlenbergii	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Juglans nigra	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	2
Celtis occidentalis	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Fraxinus americana	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Ulmus americana	3	4	7	2	2	2	1	2	1	—	—	—	—	—	—	—	—	—	—	—	—	24
U. fulva	—	2	2	1	2	3	3	3	2	1	—	1	—	—	—	—	—	—	—	—	—	20
U. racemosa	—	3	4	2	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11
Carpinus	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Ostrya	2	4	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8
Morus rubra	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Platanus	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Prunus serotina	—	—	2	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—	—	—	—	6
Cercis	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Cornus florida	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Vitis sp?	7	3	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11